

1 Substitute Specification with amendments shown.

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3 DISCLOSURE OF INVENTION

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5 TITLE: A Bio-reactive Grease and Oil Separator

6 This application ^{pend}ends from that Provisional Application No. 60/040,690 filed

7 March 13, 1997

8 Field of The Invention

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10 The invention herein relates to the separation and removal of oil and grease from
11 wastewater.

12 Background of The Invention

13 PROBLEM SOLVED BY INVENTION:

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15 Food service establishments and industrial processing facilities generate grease,
16 oil, sugars, starches and other contaminants in their wastewater. Grease and oil are major
17 contributors to blockages and backups in drains and mains, unpleasant odors, costly
18 pumping of interceptor tanks and in extreme cases, excavation of mains, drains and tanks.

19
20 Current treatment systems have shortcomings related to incomplete separation
21 and retention. Current treatment systems concentrate mainly on separation and do not
22 address the subsequent problem of disposal of the separated substances.

23 Summary of the Invention

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25 The suggested invention addresses the complete problem presented by objection-

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1 able substances through the application of fluid mechanics and bio-technology.

3 Brief Description of the Drawings

4 The foregoing and other features and advantages of the present invention will
5 become more readily appreciated as the same become better understood by reference to
6 the following detailed description of the preferred embodiment of the invention when
7 taken in conjunction with the accompanying drawings, wherein:

10
11 Figure 1. is a depiction of a reactive grease separation assembly comprised of a media
12 matrix (1). The media matrix comprised of at least one inner core (70) received into a
13 tube (20). The media matrix (1) depicted is comprised of a plurality of tubes (20) each
14 receiving at least one inner core (70). Each tube (20) is sized to receive an elongated
15 media inner core (70). The inner core (70) having at least one vane (90), and as depicted
16 having a plurality of vanes (90) and as depicted at least eight vanes (90). The at least one
17 vane (90) extending from a central core element (95) where the central core element (95)
18 coincides with the tube axis (25). The central core element (95) of at least one inner core
19 (70) parallel with the central core element (95) of other at least one inner core (70).

22 The at least one inner core (70) has a top (75) and a bottom (80) and a length
23 (85). The tube (20) having a tube top (25), tube bottom (30) and tube length (35) and
24 tube (20) having a tube axis (37) centrally positioned from the tube top (25) to the tube
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1 bottom (30) and extending throughout the tube length (35) of each tube (20). The tube
2 (20) in the preferred embodiment being cylindrical but not thereby limited to other
3 geometric cross-sections and shapes. The tube length (35) generally less than the inner
4 core length (85). As will be appreciated by one of ordinary skill in the art, the tube (20)
5 receiving at least one inner core (70) may be positioned at any location along the inner
6 core length (85), i.e., such that the tube top (25) is proximal the inner core top (75), such
7 that the tube bottom (30) is proximal the inner core bottom (85) or such that the tube (20)
8 is positioned intermediate the inner core top (75) and inner core bottom (80).
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11 The tube (20) having an inner wall (140) where at least one depression or groove
12 (150) is formed in the inner wall (140) which receives at least one vane (90), of the at
13 least one inner core (70) received into the tube (20), at a vane tip (98). The groove (150)
14 comprising vane (90) restraining means securing the at least one inner core (70) in a
15 fixed position within said tube (20). It will be appreciated by those of ordinary skill in
16 the arts that the groove (150) may be a structure extending from the inner wall (140)
17 forming a groove (150) which will receive at least one vane (90). Alternatively it is
18 understood that the groove (150) may be a depression formed into the inner wall (140)
19 capable of receiving the at least one vane (90). Vane (90) restraining means may be by a
20 friction fit between the vane tip (98) when received into a groove (150) or by application
21 of an adhesive or a mechanical fixing means between the vane tip (98) and the groove
22 (150). In the preferred embodiment at least two depressions or grooves (150) are formed
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1 in the inner wall (140) with each of said grooves (150) receiving at least one vane (90).
2 The at least one vane having a vane surface (92). The at least one vane (90) extending
3 from the central core element (25) along the length of said central core element (25). The
4 surface (92) covered with a biofilm (97). In the preferred embodiment at least eight vanes
5 (90) are spaced equidistant from the adjoining vane (90) and extending from the central
6 core element (25).

7
8 The tube (20) having an outer wall (190) having at least one fin (200) extending
9 outwardly therefrom. As depicted the tube (20) has at least four fins (200) extending
10 from said outer wall (190). However, one of ordinary skill in the arts will appreciate that
11 fins of 1...n may be employed in accordance with the space available and surface area
12 desired. The fin (200) is generally elongated having a fin surface (210) and, in the
13 preferred embodiment, extends outwardly from the tube outer wall (190). Where a
14 plurality of tubes (20) are utilized the plurality of tubes (20) contact adjacent tubes (20) at
15 the respective tube outer walls (190) at at least one contact point (195) where, in the
16 preferred embodiment, affixing means, including adhesives, mechanical fasteners and
17 other methods or devices as are appreciated by those in the affixing arts, are utilized to fix
18 adjacent tubes together and hence to fix the position of the plurality of tubes (20) within
19 the media matrix (1). Tube at least one contact points (195) are, in the preferred
20 embodiment, flattened surfaces extending from the tube top (25) to the tube bottom (30)
21 parallel with the tube axis (37). In an alternative embodiment, tubes (20) in a media

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1 matrix (1) may be alternatively or additionally fixed in position by affixing means
2 employed at an intersection of fins (200) of adjoining tubes (20).

3 The tube inner wall (140) having an inner wall surface (142), the tube outer wall
4 (190) having an outer wall surface (192). Inner wall surface (142), outer wall surface
5 (192), vane surface (92) and fin surface (210) receive biofilm (97).

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8 Figure 2 is a top plan view of a media matrix

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11 Figure 3 is a section view of an inner core showing a plurality of vanes.

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13 Figure 4 is a section view of a tube showing an inner wall, an outer wall, at least one
14 groove and at least one fin.

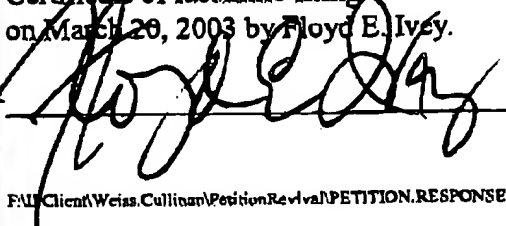
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17 Figure 5 is a detail showing the groove which receives at least one vane.

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20 Figure 6 is a top view of a grease separator media matrix container (250). The top (290)
21 is depicted. Wastewater inlet (350) and discharge pipes (400) are depicted.

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23 Figure 7, 9 and 11 depict the grease separator media matrix container (250) in back view,
24 section view and side view. Wastewater inlet and discharge pipes are depicted.

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1 Figure 8 depicts the top.

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3 Figure 10 is a detail from Figure 9 showing the discharge pipe (400).

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6 DETAILED DESCRIPTION

7 DESCRIPTION OF THE INVENTION:

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10 Figures 1 through 11 depict the preferred embodiment of the invention. The
11 proposed invention consists of a superpermeable interactive membrane or media,
12 depicted in Figures 1 through 5 (see attached diagram) which as a result of its unique
13 geometric configuration, produces a predictable fluid flow conducive to the release of
14 suspended materials and the transportation of the substances to a companion geometric
15 configuration of tube inner wall surfaces (142), tube outer wall surfaces (192), of vane
16 surfaces (92) and fin surfaces (210) which are designed to maximize surface area,
17 regulate laminar flow within vertical surfaces to encourage the development of and
18 maximize the production of a live biofilm (97) and to maintain a beneficial environment
19 for bio-oxidation. The membrane/media/substrate/containment or media matrix (1) and
20 grease separator media matrix container (250), is comprised, in the preferred
21 embodiment, of a plurality of cylindrical tubes (20), each having a tube axis (37) centrally
22 positioned from the tube top (25) to the tube bottom (30) and throughout the tube length
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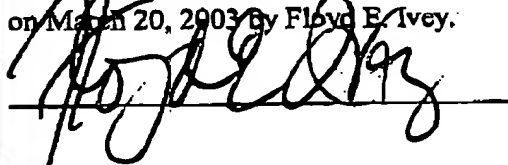
1 (35) of each tube (20). Each tube (20) is sized to receive an elongated media inner core
2 (70). The media matrix (1) is comprised of at least one inner core (70) received into at
3 least one tube (20). The at least one inner core (70) is, in the preferred embodiment,
4 having an inner core length (85) greater than the tube length (35) of the at least one tube
5 (20) into which it is received.

7 The media matrix (1) depicted is comprised of a plurality of tubes (20) each
8 receiving at least one inner core (70). The inner core (70) having at least one vane (90),
9 and as depicted having at least eight vanes (90). The at least one vane (90) extending
10 from a central core element (95) where the central core element (95) coincides with the
11 tube axis (25). The at least one vane (90) extending from the central core element (25)
12 along the length of said central core element (25). The at least one vane (90) has a
13 surface (92). The surface (92) covered with a biofilm (97). In the preferred
14 embodiment at least eight vanes (90) are spaced equidistant from the adjoining vane (90)
15 and extending from the central core element (25).

18 The tube (20) having an inner wall (140) where at least one depression or groove
19 (150) is formed in the inner wall (140) which receives at least one vane (90) of the inner
20 core (70) received into the tube (20). The groove (150) comprising means of restraining
21 the at least one inner core (70) in a fixed position within said tube (20). It will be
22 appreciated by those of ordinary skill in the arts that the groove (150) may be a structure
23 extending from the inner wall (140) forming a groove (150) which will receive at least
24 extending from the inner wall (140) forming a groove (150) which will receive at least
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1 one vane (90). Alternatively it is understood that the groove (150) may be a depression
2 formed into the inner wall (140) capable of receiving the at least one vane. It will be
3 appreciated that the tube (20) may be of a length less than the length of the at least one
4 inner core (70) received by the at least one tube (20). One of ordinary skill will
5 appreciate that the at least one tube (20) receiving an at least one inner core (70) may be
6 positioned at the top, middle or bottom of the at least one inner core (70) and thereby
7 fulfill the function of fixing the position of the at least one inner core (70). In the
8 preferred embodiment at least two depressions or grooves (150) are formed in the inner
9 wall (140) with each of said grooves (150) receiving at least one vane (90). The tube (20)
10 having an outer wall (190) having at least one fin (200) extending therefrom. As depicted
11 the tube (20) has at least four fins (200) extending from said outer wall (190). The fin
12 (200) is generally elongated having a fin surface (210) and, in the preferred embodiment,
13 extends outwardly from the tube outer wall (190) so as to contact at least one fin (200)
14 from at least one additional tube (20). The fins (200) are interconnected by means
15 thereby fixing the positions of a plurality tubes (20) and hence comprising the tubes (20)
16 required in forming a media matrix (1). In the preferred embodiment, as seen in Figures 6
17 through 11, a grease separator media matrix container (250) is sized to receive the media
18 matrix (1). Wastewater inlet (350), (375) and discharge pipes (400) are depicted. Vane
19 surfaces (92) and fin surfaces (210) comprise surface area, regulate laminar flow within
20 vertical surfaces to encourage the development of and maximize the production of a live

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1 biofilm and to maintain a beneficial environment for bio-oxidation.

2 The media matrix (1) may be configured to a multitude of applications
3 appropriate to each treatment task. The application depicted, as seen in Figures 1 through
4 11 (see diagram) is intended for greywater remediation. While the preferred application of
5 the elements of the suggested invention are interactive, each element may be applied to
6 fluid treatment independently.
7

8 Fluid flow parallel to the media surfaces produces continuous contact between
9 the fluid and surface area of the media which, when covered with a biofilm, effects more
10 efficient mass transfer of an organic or inorganic substrate within the biofilm thereby
11 assisting retention, decomposition and/or biotransformation.
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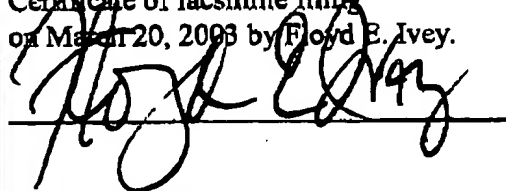
13 While a preferred embodiment of the present invention has been shown and
14 described, it will be apparent to those skilled in the art that many changes and
15 modifications may be made without departing from the invention in its broader aspects.
16 The appended claims are therefore intended to cover all such changes and modifications
17 as fall within the true spirit and scope of the invention.
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23 In the Drawings

24 The Drawings are amended to eliminate portions of the dimensioning references
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1 and comments. Reference numerals are added to correspond with the Detailed
2 Description. Formal drawings will be provided upon the Examiner's allowance of any
3 claim. Some written comments on the drawings may prompt a future amendment to the
4 specification with the written comments then removed from the drawings.
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